

**A Review of the History and Justification for Size Limits in  
Alaskan King, Tanner, and Snow Crab Fisheries**

by

**William E. Donaldson**

and

**Wayne K. Donaldson**

August 1992



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## ABSTRACT

Minimum size limits for male red *Paralithodes camtschaticus* blue *P. platypus*, and golden king crabs *Lithodes aequispina*, and Tanner *Chionoecetes bairdi* and snow crabs *C. opilio* are used to manage commercial fisheries in Alaska. King crab size limits were first developed for red king crab in 1939 and expanded to cover fisheries for blue and golden king crab in subsequent years. Original justifications for size limits in Alaskan crab fisheries were mostly economic in nature and paralleled more established shellfisheries worldwide. The size limits developed for Tanner and snow crab were based on growth studies and reproductive requirements. Because of marketing considerations, the industry has imposed a size limit on snow crab which is 0.9 in larger than the biological size at which it could be harvested.



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## INTRODUCTION

As explained by Gulland (1974), "A regulatory body concerned with the management of a fish stock has available to it a variety of types of explicit regulations which can be introduced to achieve its purposes." Size limit regulations provide a simple management tool to protect the reproductive capacity of a population and have been used for over 100 years in the management of various shellfisheries around the world.

The traditional justification for establishing minimum size limits has been to protect breeding stocks by setting the minimum size limit greater than the size at sexual maturity. However, size limits must also recognize the minimum acceptable size for the market. More recently, yield-per-recruit analysis has helped define optimum minimum sizes for harvest. However, as Miller (1976) observed for North American shellfisheries, some regulations may not be optimum according to either biological or economic criteria, but they have met the "demanding test of political feasibility."

In 1877, England, Wales, and Scotland adopted the first conservation measures for the British shellfish industry (Edwards 1988): *The Fisheries Act*. It included a minimum landing size for *Cancer* crabs of 4.25-in carapace width and protected "soft-shelled crabs" and crabs carrying "spawn." Edwards (1988) reports that the regulation of Great Britain's crab fisheries remained static for 74 years; then in 1951 the minimum landing size was raised to 4.5 in to better protect crab stocks. Prior to that, the setting of a minimum landing size was mainly based on the commercial requirement for better quality crabs for market (Edwards 1988). In 1976 regional size limits were proposed based on the sex of crab landed and maximum sustained yield analysis. However, regional size limits were not adopted until 1986, despite support from the fishing industry.

Early attempts in 1873 at regulating the American lobster *Homarus americanus* fishery on the east coast of Canada included prohibitions on the capture of soft-shelled lobsters, egg-bearing females, and lobsters weighing <1.5 lb (DeWolf 1974). In 1874 the weight limit was changed to a 9.0-in total length limit because of difficulty enforcing the weight limit. Minimum size limits have been separately designated for

different fishing districts during the history of the fishery. According to Wilder (1965), minimum size limits are now intended to increase sustained yield by allowing more lobsters to mature and reproduce or to grow large enough during the optimum growth period to more than offset losses from natural mortality. After assessing the available data, Wilder concluded that regulations that specify fishing season, prohibit the sale of egg-bearing lobsters, and establish minimum legal sizes had little effect on sustaining the weight of landed lobsters and that "environmental factors such as temperature, type of bottom (cover), food, competition, predation and possibly disease play a much more important role in determining the sustained yield from the various regions."

After reviewing the history of the Canadian lobster fishery, DeWolf (1974) concluded that the effects of size limits on biological productivity and price are hard to quantify because of other factors, such as trap limits. Where size limits have been introduced, changed, or abolished, DeWolf reported that "the results have not been such that definite conclusions can be drawn."

Dungeness crab *Cancer magister* fisheries developed in central California in the 1860s. Size, sex, and season regulations were adopted between 1897 and 1905 in an attempt to preserve the reproductive potential of populations (Methot 1988). According to Methot, conservation of male reproductive stock seems to be adequately achieved with current size limits. However, most males harvested each season are larger than the size limit, so the majority of the male breeding stock are smaller males. Therefore, according to Methot, a size limit combined with a high exploitation rate on larger males has potential for genetic selection of slower growing males.

The rock lobster *Panulirus cygnus* fishery is the most valuable single-species fishery in Australia (Phillips and Brown 1988). A minimum legal weight equivalent to a 3.0-in carapace length was implemented in 1887 (Bowen and Hancock 1988). Both males and females are harvested in this fishery, and the current minimum legal size, a 3.0-in carapace length, is generally smaller than the size of first-breeding females. According to Phillips and Brown (1988), the harvest is composed mostly of animals that are not

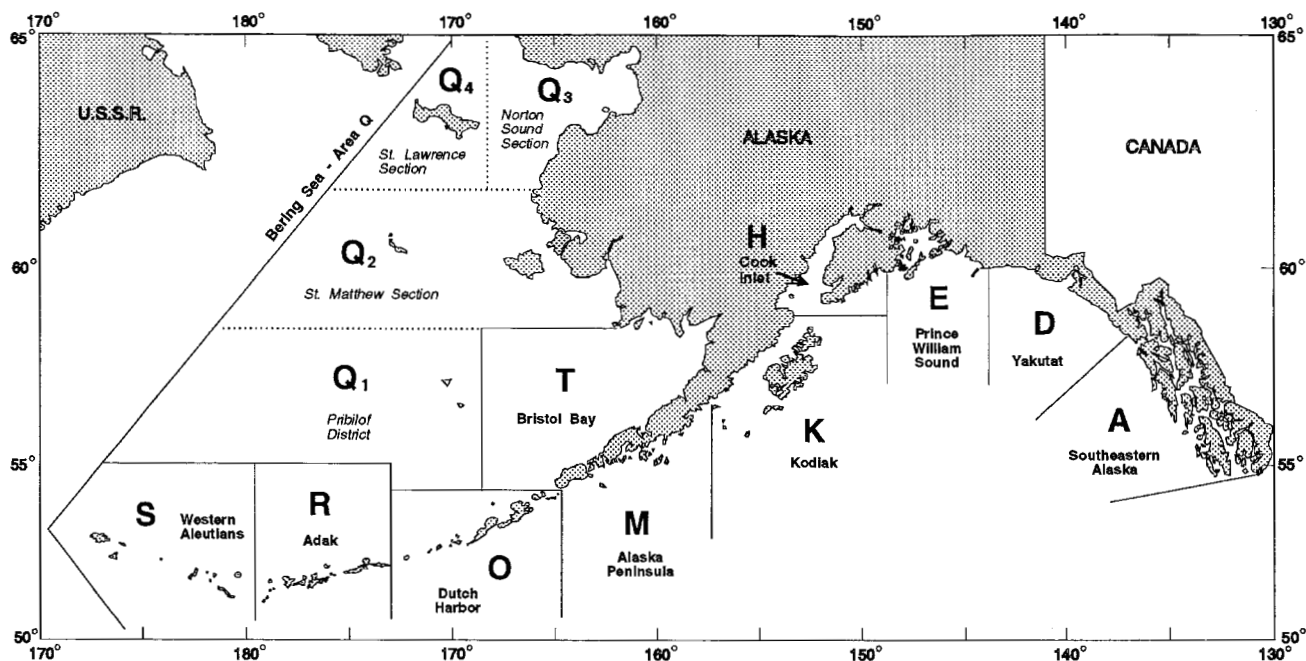


FIGURE 1.—Alaska king crab management areas. Yakutat (Area D) was separated from Southeastern Alaska in 1988. Bristol Bay (Area T) was separated from Bering Sea in 1980.

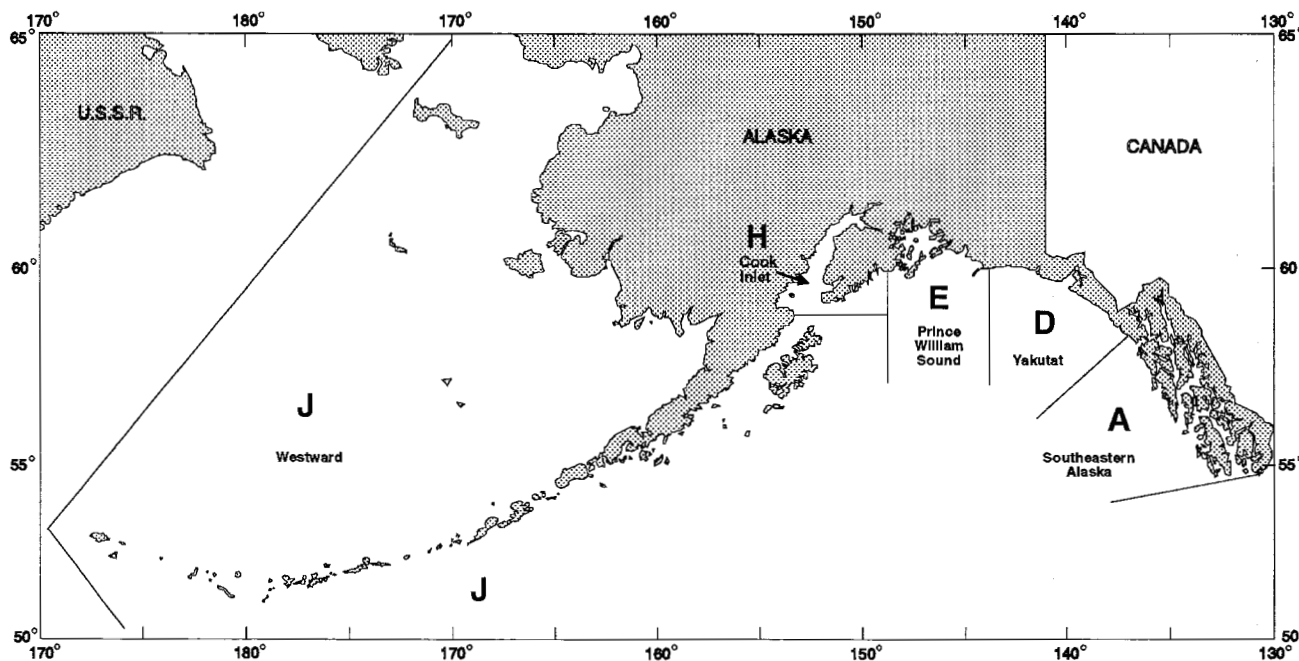


FIGURE 2.—Alaska Tanner and snow crab management areas. Yakutat (Area D) was separated from Southeastern Alaska in 1988.

sexually mature; furthermore, the minimum legal size has remained unchanged over a long period. They emphasize, therefore, that it is only through close cooperation of all parties involved that it has been possible to maintain a fishery.

The logic employed in setting size limits elsewhere was probably synthesized and used by managers to establish minimum size limits for Alaska's fisheries for red *Paralithodes camtschaticus*, blue *P. platypus*, and golden king crabs *Lithodes aequispina*, as well as Tanner crab *Chionoecetes bairdi* and snow crab *C. opilio*. The management objective implicit in establishing minimum size limits, as well as prohibiting the taking of females, has been to protect the reproductive potential of these crab stocks. Before establishment of minimum size regulations, the size of crabs harvested was dictated by market conditions and demand; these conditions subsequently influenced the establishment of initial minimum size limits for all species of king crabs.

We prepared this historical review of size limits in Alaska's king, Tanner, and snow crab fisheries to document past and present size limits. Justification for the size limit changes were included where available. This information should simplify and enhance future understanding and analysis of crab size-limits in Alaska.

## INFORMATION SOURCES AND LIMITATIONS

Prior to 1949 the regulation of Alaskan commercial fisheries was the responsibility of the U.S. Fish and Wildlife Service. The Alaska Department of Fisheries and the Alaska Fisheries Board were created by the 19th Territorial Legislature on March 21, 1949; these eventually became known as the Alaska Department of Fish and Game (ADF&G) and the Alaska Board of Fish and Game, respectively. The board was later split into the Alaska Board of Game and the Alaska Board of Fish (BOF). Alaska attained statehood in 1959 and assumed control of the regulation of crab fisheries in Alaskan waters on January 1, 1960 (ADF&G *undated*).

The Alaska Board of Fish and ADF&G divided the waters of Alaska into management or statistical areas defining distinct fisheries for king, Tanner, and snow

crabs (Figure 1, 2). We obtained information on commercial size limits and the reasons for establishing and changing commercial size limits for these fisheries from ADF&G and board documents, especially those produced during the time that most of the size-limit regulations evolved. In instances in which explanations justifying the size limit changes could not be found, we made no attempt to suggest possible explanations.

Size limits apply to the male of the species because females cannot be taken and sold; commercial harvest of female crab in Alaskan waters was first prohibited beginning with the Cook Inlet area in 1939 (USDC 1939). In many instances the board did not specifically assign a size-limit regulation to a management area or subarea but instead relied on a *general provision* (i.e., a regulation that applies statewide unless modified by an area-specific regulation). Tables in this report documenting size limits by year and management area do not mean that a commercial fishery took place, only that a size limit(s) was in effect.

## RED KING CRAB SIZE LIMITS

In Alaska the size of commercially harvested red king crabs was first regulated in Cook Inlet in 1939 (Figure 1; Table 1; USDC 1939):

Crab Fishery — King or Spider Crab (*Paralithodes camtschatica* [*camtschaticus*]). — No female of this species shall be taken at any time, and no male of this species measuring less than 5.5 inches in greatest width of shell shall be taken for commercial purposes.

In referring to this decision, ADF&G (1961) reported, "No reason for this size has as yet been discovered in any of the literature relative to crab growth and maturity." Otto (1985) speculated that it may have been intended to eliminate the landing of small males that contained little meat. In 1942 an Alaska-wide size of 5.5 in was implemented (USDI 1942); it remained unchanged until 1950 when it was raised to 6.5 in by the Alaska Territorial Fisheries Board in conjunction with the U.S. Fish and Wildlife Service (Miller 1965). Otto (1985) suggested that this size was established to allow males to spawn at least once before entering the fishery; however, no reference was cited for his suggestion. The following explanation was offered by ADF&G (1961) and subsequently reiterated by Miller (1965).

TABLE 1.—Legal size limits (carapace width in inches) for red king crab in Alaska by geographic management area. Size limits separated with a slash (/) are for the first (left) and second (right) seasons. Numbers in bold type indicate change in size limit from the previous years(s).

Year	General Provision	Geographic Area <sup>c</sup>										
		S.E.	Yakutat	PWS	C.I.	Kodiak	Ak. Pen.	D.H.	Adak	W. Aleut.	Bering S.	B.B.
1939	None	None		None	5.5	None	None	None	None	None	None	
1940	None	None		None	5.5	None	None	None	None	None	None	
1941	None	None		None	5.5	None	None	None	None	None	None	
1942	<b>5.5</b>	<b>5.5</b>		<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	
1943	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1944	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1945	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1946	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1947	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1948	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1949	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1950	<b>6.5</b>	<b>6.5</b>		<b>6.5</b>	<b>6.5</b>	<b>6.5</b>	<b>6.5</b>	<b>6.5</b>	<b>6.5</b>	<b>6.5</b>	<b>6.5</b>	
1951	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1952	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1953	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1954	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1955	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1956	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1957	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1958	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1959	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1960	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1961	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1962	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1963	6.5	6.5		6.5	<b>7.0</b>	<b>7.0</b>	6.5	6.5	6.5	6.5	6.5	
1964	6.5	6.5		6.5	7.0	7.0	6.5	6.5	6.5	6.5	6.5	
1965	6.5	6.5		6.5	7.0	7.0	6.5	6.5	6.5	6.5	6.5	
1966	6.5	6.5		6.5	7.0	7.0	6.5	6.5	6.5	6.5	6.5/5.75	
1967	6.5	6.5		6.5	7.0	7.0	6.5	6.5	6.5	6.5	6.5/5.75	
1968	6.5	6.5		6.5	7.0	7.0	6.5/7.0	6.5/7.0	6.5/7.0	6.5/7.0	6.5/5.75	
1969	<b>7.0</b>	<b>7.0</b>		<b>7.0</b>	7.0	7.0	<b>7.0</b>	<b>7.0</b>	<b>7.0</b>	<b>7.0</b>	<b>7.0/5.75<sup>a</sup></b>	
1970	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	<b>7.0</b>	7.0/5.75 <sup>a</sup>	
1971	7.0	7.0		7.0	7.0	7.0	<b>6.5</b>	<b>6.5</b>	<b>6.5</b>	6.5	<b>6.25/6.5</b>	
1972	7.0	7.0		7.0	7.0	7.0	6.5	6.5	6.5	6.5	6.25/6.5	
1973	7.0	7.0		7.0	7.0	7.0	6.5	6.5	6.5	6.5	6.25/6.5	
1974	7.0	7.0		7.0	7.0	7.0	6.5	6.5	6.5	6.5	6.25/6.5	
1975	7.0	7.0		7.0	7.0	<b>7.0/8.0</b>	6.5	6.5	6.5	6.5	6.25/6.5	
1976	7.0	<b>7.0/8.0</b>		7.0	<b>7.0/8.0</b>	7.0/8.0	6.5	<b>6.5/8.0</b>	6.5	6.5	<b>6.5</b>	
1977	7.0	7.0/8.0		7.0	7.0/8.0	7.0/8.0	<b>6.5/7.5</b>	<b>6.5/7.5</b>	6.5	6.5	<b>5.0<sup>b</sup></b> 6.5	
1978	7.0	7.0/8.0		7.0	7.0/8.0	<b>7.0/7.5</b>	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> 6.5	
1979	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup>/7.5</b>	
1980	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup>/7.0</b> <b>6.5/7.0</b>	
1981	7.0	7.0/8.0		7.0	7.0/8.0	<b>7.0</b>	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup>/7.0</b> <b>6.5/7.0</b>	
1982	7.0	7.0/8.0		7.0	7.0/8.0	<b>7.0/7.5</b>	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup>/7.5</b> <b>6.5/7.0</b>	
1983	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup>/7.5</b> <b>6.5/7.0</b>	
1984	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup>/7.5</b> <b>6.5/7.0</b>	
1985	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup></b> <b>6.5/7.0</b>	
1986	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup></b> <b>6.5/7.0</b>	
1987	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup></b> <b>6.5/7.0</b>	
1988	7.0	7.0/8.0	<b>7.0/8.0</b>	7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup></b> <b>6.5/7.0</b>	
1989	7.0	7.0/8.0	7.0/8.0	7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup></b> <b>6.5/7.0</b>	
1990	7.0	7.0/8.0	7.0/8.0	7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup></b> <b>6.5/7.0</b>	
1991	7.0	7.0/8.0	7.0/8.0	7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>c</sup>		<b>4.75<sup>b</sup></b> <b>6.5<sup>d</sup></b> <b>6.5/7.0</b>	

<sup>a</sup>Size during foreign fishery.

<sup>b</sup>Northern District (Q2-4; see Figure 1).

<sup>c</sup>In 1978 the Western Aleutian area was included under the Adak area.

<sup>d</sup>Pribilof District (Q1; see Figure 1).

<sup>e</sup>S.E. = Southeastern, PWS = Prince William Sound, C.I. = Cook Inlet, Ak. Pen. = Alaska Peninsula, D.H. = Dutch Harbor, B.B. = Bristol Bay.

The only reference literature that can be found that supports this size is a passing reference by Marukawa (1933) where the Japanese were prohibited from taking crab under 165 mm wide, which is approximately 6.5 inches. The 165 mm width represents the approximate maximum size of females on the west side of the Pacific and represents a size at which the males have been sexually mature for two or more seasons. The present regulation also coincides with just about the minimum size the industry can profitably process.

The 1950 minimum size limit remained the same for the next 13 years. In 1963 a size of 7.0 in was implemented for the Cook Inlet and Kodiak fisheries. Otto (1985) assumed that the justification for the change to 7.0 in was based on growth and mating studies. According to Gray (see Appendix A.1) the justification for this change was "proper utilization and preservation (until more biological knowledge is obtained)." That is, the justification was based on market economics. Gray provided some insight (Appendix A.2):

An increase of this magnitude will make the crab more desirable from both the canned product and frozen section standpoint. Larger crabs reduce processing costs in canning since each crab is handled individually and the larger the crab, the more meat obtained. Larger crabs also produce a better looking frozen product with less labor. Two canneries have voluntarily gone to the 7 inch limit to reduce production costs. Biologically, the justification of the size increase is more nebulous and based to a great extent on theory and not established fact.

He concluded that for the Kodiak area "a 7 inch size limit is definitely justified economically and will serve a biological safeguard until more concrete data on king crab reproductive potential can be obtained." With the completion of size-at-maturity, growth, and mating research in the late 1960s and early 1970s, biological arguments were manifested which favored protecting males from harvest until they could participate in mating. Assuming an average width at maturity of 4.0 in and allowing 3 years for mating, the size limit for male red king crab in Kodiak was set at 7.0 in.

In 1966, however, a size limit in the Bering Sea of 5.75 in was in effect when foreign fleets were taking red king crabs (Figure 1). Justification for the change was found in a report of unknown origin that was archived by Donaldson (1992; Appendix B.1):

The only exception permitted for the taking of King Crab under seven inches was in the Bering Sea and that was limited to the approximate times that foreign fishing fleets (Japanese and Russian) are in the same area and are permit-

ted (by international agreements) to take smaller crab. During such times the Alaska fishermen may keep crab as small as 5 3/4 inches across their back shells.

This allowed U.S. fishermen to better compete with the foreign fleet (Otto 1985). The size limit in all other areas remained either 6.5 or 7.0 in.

For the 1968 fisheries only a second fishing season with a 7.0-in size limit was allowed for the Alaska Peninsula, Dutch Harbor, Adak, and Western Aleutian fisheries (Figure 1). This was Alaska's first use of *second seasons* (per year) for crab fisheries. Thereafter second seasons with larger size limits than first seasons were often used to allow the commercial fishery to harvest more of the older crabs that were not expected to survive much longer (ADF&G 1981).

In 1969 a 7.0-in size limit was imposed statewide. In the Bering Sea, however, the 5.75-in size limit was retained for periods when foreign fisheries operated in the area.

In 1971 the size limit was again reduced to 6.5 in for the Alaska Peninsula, Dutch Harbor, Adak, and Western Aleutians management areas. The Bering Sea size limit was reduced to 6.25 in with a 6.5-in second season. These reductions were in response to Otto's (1985) documentation of lower growth rates in these areas.

An 8.0-in second season was allowed in the Kodiak area beginning in 1975 to promote the harvest of older crabs. This second 8.0-in season was extended to Southeastern Alaska, Cook Inlet, and Dutch Harbor in 1976. In 1976 the Bering Sea minimum size was increased to 6.5 in.

In 1977 the second-season size was subsequently reduced to 7.5 in for Dutch Harbor and the Alaska Peninsula and likewise for Kodiak in 1978. The justification for lowering the size limit for the Kodiak area was reported in ADF&G (1978a):

Originally the eight inch (203 mm) size limit was placed 5 mm higher than what growth per molt data indicated (7 4/5 inches, 198 mm). The 7 4/5 inch size was an unwieldy figure at the time, so eight inches was adopted instead. The main purpose for lowering the limit was to achieve a higher utilization of larger and older crabs. Many recruits skip molt the year following recruitment and therefore remain recruit size, automatically gaining protection from harvest when the 8 inch limit goes into effect. Lowering the limit is necessary in order to further harvest these post recruit "ones" and "twos" that are still of recruit size.



In the newly established Northern District of the Bering Sea, a red king crab fishery was opened in 1977 using a minimum size limit of 5.0 in. According to ADF&G (1971a), "The data showed the Northern populations to be of smaller average size than the Southeastern and Pribilof district crab." In 1978 the size limit was reduced to 4.75 in. Also in that year the Western Aleutians area was combined under the Adak area.

A second-season size limit of 7.5 in was added for the 1979 Bering Sea fishery and reduced to 7.0 in for the 1980 fishery. In 1980 the BOF divided the Bering Sea area into two management areas: Bristol Bay and the Bering Sea. The Bering Sea area was further divided into the Pribilof District (6.5 in) in addition to the Northern District (4.75 in), as mentioned earlier. The Northern District contained the Norton Sound Section. A first-season size limit of 6.5 in and a 7.0-in second season were adopted for the Bristol Bay area. Second-season sizes were raised to 7.5 in from 1982 through 1984 in the Bering Sea area. The second season was repealed altogether for the Bering Sea area in 1985 and has not been reinstated. In 1984 the Northern District was further divided into the Saint Matthew and Saint Lawrence Island Sections: 4.75 in size limits in each. No changes to red king crab size limits have occurred since 1984.

## BLUE KING CRAB SIZE LIMITS

From 1942 through 1962 size limits imposed on the commercial harvest of blue king crabs were those specified under the general provisions for all species of king crab and all management areas. From 1942 to 1949 the size limit was a carapace width of 5.5 in (Table 2). In 1950 this was increased to 6.5 in. The justification for these sizes was previously described for red king crab. In 1963 a size of 5.0 in carapace *length* was instituted for the Prince William Sound fishery. The justification was based on a 1962 study of blue king crab in Prince William Sound (ADF&G 1979b):

Sixty-one percent of the crabs sampled were equal to or greater than 6 inches in width (a dimension which Baxter [claimed equaled 5 inches in length]). Also, Baxter found that skipmolting occurred in 43 percent of the crabs that were larger than 6 inches in width. To quote Baxter, the

skipping of a molt probably indicates a crab is near, or has attained maturity. Therefore, it is possible that blue crab mature at a length (sic) less than 6 inches.

Thus Baxter felt that lowering the minimum size from 6.5 inches in width to 6 inches in width would adequately protect the brood stock while also allowing for sufficient males to be harvested in the commercial fishery. Baxter justified establishing a length measurement by stating that, King crab are measured at the greatest width of the carapace, which for red king crab may be either from the tips of two opposing spines or across the body itself. Very often the spines of the blue crab are not opposite each other, thus the greatest width measured at right angles to the median line is from one spine to the opposite edge of the carapace. Another problem when measuring crab occurs when the spines are knocked off, thus making it difficult to determine if the crab might be undersize[d]. I believe that a more exact and correct form of measurement, and one that would eliminate disputes over legality, would be from the eye notch to the center edge of the rear of the carapace. A six inch blue crab, measured widthwise, is about five inches from eye notch to posterior edge of carapace.

The 5.0-in length measurement remained in effect through 1977, when it was converted to a 6.0-in width measurement. "This was proposed simply as a house-keeping measure to make Prince William Sound consistent with the rest of the state in regards to the method of measuring crabs." In 1979 the size limit for the Prince William Sound fishery was reduced from 6.0 to 5.9 in carapace width because of litigation over the correct length-width conversion (ADF&G 1979b).

In all other areas the minimum size remained at 6.5 in until 1969, when it was raised to 7.0 in; more specifically, the general provision was raised to 7.0 in for "king crab," albeit the target of the change was red king crab. This raised the size limit in all areas for both red and blue king crab through 1973, except in Prince William Sound where a size limit of 5.0 in was in place specifically for blue king crab.

In 1974 the blue king crab size limit was reduced to 6.5 in for the Alaska Peninsula, Dutch Harbor, Adak, and Western Aleutians areas; additionally, 6.25- and 6.5-in size limits were imposed in the Bering Sea area. We found no written explanation for the reductions to 6.5 in; however, they were most likely set to coincide with the 6.5-in size limit on red king crab. According to the justification in an ADF&G staff regulatory proposal (Appendix B.2): "The 6 1/4-in size was originally adopted to coincide with the size limit effective for foreign fishermen in the Bering Sea. With the elimination of foreign effort the size limit

TABLE 2.—Legal size limits (carapace width in inches) for blue king crab in Alaska by geographic management area. Size limits separated with a slash (/) are for the first (left) and second (right) seasons. Numbers in bold type indicate change in size limit from the previous year(s).

Year	General Provision	Geographic Area <sup>c</sup>										
		S.E.	Yakutat	PWS	C.I.	Kodiak	Ak. Pen.	D.H.	Adak	W. Aleut.	Bering S.	B.B.
1939	None	None		None	None	None	None	None	None	None	None	
1940	None	None		None	None	None	None	None	None	None	None	
1941	None	None		None	None	None	None	None	None	None	None	
1942	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1943	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1944	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1945	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1946	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1947	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1948	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1949	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1950	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1951	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1952	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1953	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1954	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1955	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1956	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1957	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1958	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1959	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1960	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1961	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1962	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1963	6.5	6.5		5.0 <sup>a</sup>	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1964	6.5	6.5		5.0 <sup>a</sup>	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1965	6.5	6.5		5.0 <sup>a</sup>	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1966	6.5	6.5		5.0 <sup>a</sup>	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1967	6.5	6.5		5.0 <sup>a</sup>	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1968	6.5	6.5		5.0 <sup>a</sup>	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1969	7.0	7.0		5.0 <sup>a</sup>	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
1970	7.0	7.0		5.0 <sup>a</sup>	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
1971	7.0	7.0		5.0 <sup>a</sup>	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
1972	7.0	7.0		5.0 <sup>a</sup>	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
1973	7.0	7.0		5.0 <sup>a</sup>	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
1974	7.0	7.0		5.0 <sup>a</sup>	7.0	7.0	6.5	6.5	6.5	6.5	6.25/6.5	
1975	7.0	7.0		5.0 <sup>a</sup>	7.0	7.0/8.0	6.5	6.5	6.5	6.5	6.25/6.5	
1976	7.0	7.0/8.0		5.0 <sup>a</sup>	7.0/8.0	7.0/8.0	6.5	6.5/8.0	6.5	6.5	6.5	
1977	7.0	7.0		5.0 <sup>a</sup>	7.0/8.0	7.0/8.0	6.5/7.5	6.5/7.5	6.5	6.5	6.5	
1978	7.0	6.5/8.0		6.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	
1979	7.0	6.5/8.0		5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	
1980	7.0	6.5/8.0		5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1981	7.0	6.5/8.0		5.9	7.0/8.0	7.0	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1982	7.0	6.5/8.0		5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1983	7.0	6.5/8.0		5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1984	7.0	6.5/8.0		5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1985	7.0	6.5/8.0		5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1986	7.0	6.5/8.0		5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1987	7.0	6.5/8.0		5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1988	7.0	6.5/8.0	6.5/8.0	5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1989	7.0	6.5/8.0	6.5/8.0	5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1990	7.0	6.5/8.0	6.5/8.0	5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0
1991	7.0	6.5/8.0	6.5/8.0	5.9	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>b</sup>		5.5/6.5	6.5/7.0

<sup>a</sup>Inches carapace length.

<sup>b</sup>In 1978 the Western Aleutian area was included under the Adak area.

<sup>c</sup>S.E. = Southeastern, PWS = Prince William Sound, C.I. = Cook Inlet, Ak. Pen. = Alaska Peninsula, D.H. = Dutch Harbor, B.B. = Bristol Bay.

should be at optimum size of 6-1/2 inches throughout the season." During the 1976 and 1977 seasons a 6.5-in size was in effect for the Bering Sea, but in 1978 a 5.5-in first season and a 6.5-in second season were instituted. These sizes remain in effect to the present.

The first use of a second season with larger size limits for blue king crabs was in the Kodiak area in 1975. As with the red king crab fisheries, this allowed greater exploitation of larger crabs with short life expectancies, and second seasons were quickly adopted in other areas. These second-season sizes were usually enacted for red king crab and legally covered blue king crab only in a defacto manner.

With the creation of the Bristol Bay Management Area in 1980, size limits of 6.5 and 7.0 in carapace width were adopted. In the Kodiak area in 1981 a larger second season size limit was not effected, but it was subsequently readopted in 1982. Since then, no additional changes have been made.

However, in 1990 the BOF adopted a regulation allowing the harvest of any size male or female blue king crab in Southeastern that was parasitized with the barnacle parasite *Briaorsaccus callosus* (ADF&G 1990). This was an attempt to diminish the prevalence of this parasite in the blue king crab population.

With the exception of Prince William Sound, size limits for blue king crab have been based on the economic justifications presented for red king crab. Most management areas lack size limits for blue king crab that are based on biological data.

## GOLDEN KING CRAB SIZE LIMITS

Regulation of the minimum size limit for the commercial harvest of golden king crab were included in the general provisions of federal and state regulations through 1973 (Table 3). The initial minimum size of 5.5 in was imposed in 1942, increased in 1950 to 6.5 in, and then in 1969 to 7.0 in. We found no specific studies addressing a biological size limit for golden crab during this period. Between 1974 and 1976 the minimum size was lowered to 6.5 in for the Alaska Peninsula, Dutch Harbor, Adak, and Western Aleutian areas. In the Bering Sea area the size was reduced to 6.25 in for 1974 and 1975 and then raised in 1976 to 6.5 in. These changes reflected changes to the red king

crab size limit. It is likely that both blue and golden king crab size limits followed those for red king crab because (1) the red king crab fishery was predominant, (2) more information was available on this species, and (3) it was assumed that blue and golden crabs were biologically similar to red king crabs.

However, in 1983 the minimum size limit for golden king crab was amended to 5.5 in carapace width for the Northern District of the Bering Sea by both the BOF and the North Pacific Fishery Management Council (NPFMC). The NPFMC adoption was based on a recommendation by Otto (1983):

Legal size (for red and blue king crab) is set at about two molting increments larger than the size at male maturity, and incremental growth is about 15% of carapace length. Assuming that incremental growth for golden king crab is also 15% and that males mature at 100 mm, legal size would be set at a width corresponding to 130 mm carapace length. Using the regression equation presented above and allowing a 5 mm difference between biologists' and fishermen's method's of measuring width, legal size would be 143 mm or 5.6 inches.

Otto used Somerton and Otto's (1986) analysis to show that the size at maturity is somewhat smaller than 100 mm carapace width. Otto (1983) concluded, "Allowing for some error on the conservative side, I recommend that legal size in the Northern District of area Q [Bering Sea] be set at 5.5 inches (140 mm)." (Emphasis in this and the following paragraphs was in the original.)

The reduction to 5.5 in effectively allowed a commercial fishery on golden king crabs where none had previously occurred because the incidental catch of golden crabs had indicated that the 6.5-in size limit did not provide an economically viable fishery (Appendix B.3).

However, Otto (1983) further reported to the NPFMC, "In the Aleutian Islands, there is some indication that maturity is reached at sizes in excess of 100 mm and I recommend that the legal size remain at 6.5 inches (165 mm) until the problem is further studied."

Otto further stated in discussing the eastern Bering Sea south of 58°N latitude that: "Because of the paucity of available data, and the close proximity of this area to the eastern Aleutians, I recommend that the size limit in areas of the Bering Sea south of 58° be set at 6.5 inches (165 mm) until more information becomes available."

TABLE 3.—Legal size limits (carapace width in inches) for golden king crab in Alaska by geographic management area. Size limits separated with a slash (/) are for the first (left) and second (right) seasons. Numbers in bold type indicate change in size limit from the previous year(s).

Year	General Provision	Geographic Area <sup>d</sup>										
		S.E.	Yakutat	PWS	C.I.	Kodiak	Ak. Pen.	D.H.	Adak	W. Aleut.	Bering S.	B.B.
1939	None	None		None	None	None	None	None	None	None	None	
1940	None	None		None	None	None	None	None	None	None	None	
1941	None	None		None	None	None	None	None	None	None	None	
1942	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1943	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1944	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1945	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1946	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1947	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1948	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1949	5.5	5.5		5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	
1950	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1951	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1952	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1953	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1954	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1955	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1956	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1957	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1958	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1959	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1960	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1961	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1962	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1963	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1964	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1965	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1966	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1967	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1968	6.5	6.5		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	
1969	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
1970	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
1971	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
1972	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
1973	7.0	7.0		7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
1974	7.0	7.0		7.0	7.0	7.0	6.5	6.5	6.5	6.5	6.25/6.5	
1975	7.0	7.0		7.0	7.0	7.0/8.0	6.5	6.5	6.5	6.5	6.25/6.5	
1976	7.0	7.0/8.0		7.0	7.0/8.0	7.0/8.0	6.5	6.5/8.0	6.5	6.5	6.5	
1977	7.0	7.0		7.0	7.0/8.0	7.0/8.0	6.5/7.5	6.5/7.5	6.5	6.5	6.5	
1978	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>a</sup>		6.5	
1979	7.0	7.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>a</sup>		6.5	
1980	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>a</sup>		6.5/7.0	6.5/7.0
1981	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>a</sup>		6.5/7.0	6.5/7.0
1982	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>a</sup>		6.5	6.5/7.0
1983	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.5/7.5	6.5 <sup>a</sup>		5.5 <sup>b</sup> /6.5 <sup>c</sup>	6.5/7.0
1984	7.0	7.0/8.0		7.0	7.0/8.0	7.0/7.5	6.5/7.5	6.0/7.5	6.5 <sup>a</sup>		5.5	5.5/7.0
1985	7.0	7.0/8.0		7.0	7.0/8.0	6.5/7.5	6.5/7.5	6.0/7.5	6.5 <sup>a</sup>		5.5	5.5
1986	7.0	7.0/8.0		7.0	7.0/8.0	6.5/7.5	6.5/7.5	6.0/7.5	6.5 <sup>a</sup>		5.5	5.5/7.0
1987	7.0	7.0/8.0		7.0	7.0/8.0	6.5/7.5	6.5/7.5	6.0/7.5	6.5 <sup>a</sup>		5.5	5.5/7.0
1988	7.0	7.0/8.0	7.0/8.0	7.0	7.0/8.0	6.5/7.5	6.5/7.5	6.0/7.5	6.0 <sup>a</sup>		5.5	5.5/7.0
1989	7.0	7.0/8.0	7.0/8.0	7.0	7.0/8.0	6.5/7.5	6.5/7.5	6.0/7.5	6.0 <sup>a</sup>		5.5	5.5/7.0
1990	7.0	7.0/8.0	7.0/8.0	7.0	7.0/8.0	6.5/7.5	6.5/7.5	6.0/7.5	6.0 <sup>a</sup>		5.5	5.5/7.0
1991	7.0	7.0/8.0	7.0/8.0	7.0	7.0/8.0	6.5/7.5	6.5/7.5	6.0/7.5	6.0 <sup>a</sup>		5.5	5.5/7.0

<sup>a</sup>In 1978 the Western Aleutian area was included under the Adak area.

<sup>b</sup>Northern District (Q2-4; see Figure 1).

<sup>c</sup>Pribilof District (Q1; see Figure 1).

<sup>d</sup>S.E. = Southeastern, PWS = Prince William Sound, C.I. = Cook Inlet, Ak. Pen. = Alaska Peninsula, D.H. = Dutch Harbor, B.B. = Bristol Bay.

In 1984, however, the minimum size for the Dutch Harbor area was reduced from 6.5 to 6.0 in and in the Kodiak area in 1985 from 7.0 to 6.5 in. A second season size of 7.5 in was retained in both areas.

Lastly, a change in size limits occurred in Adak in 1988: the minimum size was reduced from 6.5 to 6.0 in.

## TANNER CRAB SIZE LIMITS

Before legal size limits were established, individual processors regulated Tanner crab size based on market considerations. According to Brown (1971): "Processing and marketing problems have caused individual processors to maintain self-imposed 'size limits' and 'catch quotas' over the landings of their own fleets. While self-imposed, size limits presently act in lieu of a state regulation in protecting male breeding stocks."

Minimum commercial size limits were established for Tanner crab by the BOF in 1976 (Table 4). Based on growth and reproductive studies conducted on the Kodiak population, they adopted a size limit of 5.5 in statewide, with the exception of a 5.3-in size limit for

Prince William Sound (Figure 2). The 5.5-in size was based on testimony on Kodiak Tanner crabs provided to the BOF by ADF&G biologists (ADF&G 1978b):

The recommendation specifying 140 mm carapace width as the legal size was intended to increase the sustained yield by allowing more crabs to reach maturity and reproduce and by allowing young, faster growing crabs to attain optimum size. Male *C. bairdi* Tanner crab mature sexually at 110-115 mm carapace width. Growth during the next molt would increase size to 135 to 140 mm. Depending on skipmolting, crabs 110-139 mm would be sexually mature at least one year and up to two years before being available to the commercial fishery. This one to two year protection period is a conservative measure to protect the developing Tanner crab fishery until additional information is available on life history in each management area.

The BOF adopted a slightly smaller 5.3-in size limit for the Prince William Sound fishery based on testimony presented by both ADF&G and the public. ADF&G testimony indicated that the average size at maturity was 4.3 in for Prince William Sound. These data were from allometric growth measurements taken from Prince William Sound crabs. However, the commercial catch sampling data indicated that the Tanner crab population contained few animals above 5.5 in even though size at maturity was similar to Kodiak crabs. Furthermore, the fishery also depended on crabs between 5.3 and 5.5 in. There has been no change to these initial minimum size limits.

TABLE 4.—Legal size limits (carapace width in inches) for Tanner and snow crab in Alaska by geographic management area: Numbers in bold type indicate change in size limit from the previous year(s).

Year	General Provision	Tanner <sup>a</sup>										Snow Bering S.
		S.E.	Yakutat	PWS	C.I.	Kodiak	Chignik	S. Pen.	E. Aleut	W. Aleut	Bering S.	
1975	None	None		None	None	None	None	None	None	None	None	None
1976	<b>5.5</b>	<b>5.5</b>		<b>5.3</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	<b>5.5</b>	None
1977	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	None
1978	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	None
1979	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	None
1980	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	None
1981	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	None
1982	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	<b>3.1</b>
1983	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	3.1
1984	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	3.1
1985	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	3.1
1986	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	3.1
1987	5.5	5.5		5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	3.1
1988	5.5	5.5	5.5	5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	3.1
1989	5.5	5.5	5.5	5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	3.1
1990	5.5	5.5	5.5	5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	3.1
1991	5.5	5.5	5.5	5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	3.1

<sup>a</sup>S.E. = Southeastern, PWS = Prince William Sound, C.I. = Cook Inlet, S. Pen. = South Peninsula.

## SNOW CRAB SIZE LIMITS

A minimum size limit of 3.1 in for snow crab was adopted at the 1982 meeting of the BOF for the Westward area (Figure 2). This is the only area that snow crab inhabits in Alaska. ADF&G staff biologists provided the following justification to the BOF (Appendix C):

Crab stocks in the Westward Region have generally declined in recent years, thereby increasing harvesting pressure on newly developing fisheries such as the fishery for *opilio* Tanner crab (snow crab). It is, therefore necessary to establish a minimum biological size limit to protect these stocks from possible overharvest. Such a size limit was

established in 1976 for *bairdi*, Tanner crab....the *bairdi* size limit is that size at which 50% of the male crab population is sexually mature plus one year's growth. The *bairdi* size limit has proven successful in protecting the reproductive character of the stocks. Extending the same rationale to the *opilio* fishery results in a minimum size limit of 78 mm or 3.1 inches.

According to Otto (1989), "In 1984, the minimum size snow crab accepted by processors became fixed at about 102 mm carapace width." This economic size limit of 102 mm, or about 4.0 in, is the generally recognized size limit in the snow crab fishery to this date, even though the legal limit remains at 3.1 in.

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## **APPENDIX**





Appendix A.1.—Justification for red king crab 7-in size limit as stated in an ADF&G memorandum from George Gray to Howard Tait.

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**MEMORANDUM**

**STATE OF ALASKA**

**TO:** Dr. Howard Tait  
Division of Biological Research  
Support Building  
Juneau, Alaska

**DATE:** September 24, 1962

**FROM:** George W. Gray, Jr.  
Division of Biological Research  
Box 1306  
Kodiak, Alaska

**SUBJECT:** Activities Report

Last week I held several discussions with Dexter Lall regarding an increase in the legal size of male king crabs (see justification of 7 inch size limit). Most of the discussion centered around Alitak Bay, which is the largest king crab producer in Alaska. Dexter agreed with me that for proper utilization and preservation (until more biological knowledge is obtained), a seven inch size limit is necessary for Kodiak Island and Cook Inlet. With this in mind, he is calling a meeting of management biologists concerned with king crabs at Homer in early October and has asked me to attend.

The peninsula biologists seem undecided as to the need for a size increase on the chain. Since the fishery is rather primitive compared with Kodiak Island and Cook Inlet, it might be wise not to try and raise the chain limit if there is any danger that it might jeopardize the chances of raising the limit in Cook Inlet and Kodiak.

The cabin at Lazy Bay is nearly completed and I expect Jim Olin in town in a few days. The need for hiring carpenters did not materialize, bad weather made fishing impossible and several of the fishermen pitched in and gave Jim and Ken a hand.

Christy Self started work Friday. Vivian should have ample time for training her before she leaves for the hospital.

The photographer is developing the photos for my informational leaflet. I will forward them to you shortly.

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Appendix A.2.—Justification for red king crab 7-in size limit as stated in an ADF&G memorandum from George Gray to Dexter Hall.

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**MEMORANDUM****STATE OF ALASKA**

**TO:** Dexter Lall  
Division of Commercial Fisheries  
Box 686, Kodiak, Alaska

**DATE:** September 18, 1962

**FROM:** George W. Gray, Jr.  
Division of Biological Research  
Box 1306, Kodiak, Alaska

**SUBJECT:** Justification of 7 inch size limit.

The male king crab, *Paralithodes camtschatica* (Tilesius), grow at a rate of approximately 17 mm/year (3/4 inch). In the smaller legal size groups, growth/year is in regular increments since molting occurs every year. To obtain this data, 6,000 legal male king crabs were tagged in a 450 square mile area of offshore Alitak Bay during August 1961. Average carapace length of these tagged crabs was 153 mm or 179 mm in width (7 1/4 inches). Since these are scientific measurements and do not include the width of the spines, another 2 mm may be added bringing the width to 181 mm (7 1/4 inches by standard legal crab measurement).

To date, 2,800 tagged crabs have been recovered. Since April 1962, the first molting period after tagging, 1,400 crabs have been recovered. Better than 80% of the crabs recovered since April had molted. Skipping occurred largely in crabs over 7 1/2 inches in width.

The information obtained from last year's length frequency distributions in Alitak Bay indicates the same results as the tagging program. These length frequencies were taken from September 21, 1961 to April 2, 1962 on a weekly basis. 4,219 crabs were measured. Old shell males (non-molters) occurred chiefly in the larger size groups, as indicated by the tagging data. Almost all of the crabs under 7 1/2 inches molted. Average size of the crabs measured was similar to that of the tagging program, (153 mm length).

Similar length frequency distributions in Twoheaded Island show larger average sized crabs and more old shells present, indicating other areas could sustain the pressure caused by raising the size limit.

-- Continued --

Appendix A.1.—(page 2 of 2).

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Present data indicate that a size increase of at least 1/2 inch can be justified economically. Assuming the average size of legal male king crabs is 7 1/4 inches in Alitak Bay, better than 50% of the crabs now available to the fishery will still be available with a 1/2 inch size increase (to 7 inches). Almost all of the crabs not available to the fishery the first year after the size increase, will molt and appear in the next year's catch. These crabs will have increased from 6 1/2 to 7 1/4 inches or -7 inches to 7 3/4 inches. An increase of this magnitude will make the crab more desirable from both the canned product and frozen section standpoint. Larger crabs reduce processing costs in canning since each crab is handled individually and the larger the crab, the more meat obtained. Larger crabs also produce a better looking frozen product with less labor. Two canneries in the Kodiak area have voluntarily gone to the 7 inch limit to reduce production costs.

Biologically, the justification of a size increase is more nebulous and based to a great extent on theory and not established fact. One of the most recent and important theories advanced is that old shelled males contribute most heavily to reproduction. This theory is based on the fact that in the Bering Sea, the new shelled males are not found with the females during the mating period. Work has been undertaken to discover whether this holds true for Kodiak. Exploratory dragging was done in Alitak Bay this past May. Samples of the male reproductive tracts of all sizes and shell conditions over 6 inches were also set to Seattle for analysis. The results of these studies at present are inconclusive but more work is planned.

Female fecundity checks in Alitak Bay showed as high as 10% of the females checked lacked eggs. Females lacking eggs were chiefly in the larger size groups which contributes the most larvae. Female fecundity checks from other areas showed less than 1% of the females without eggs. Lack of old shelled males or larger males may have caused the excessive number of barren females in Alitak Bay.

Comparison of length frequency distributions taken in 1954 and 1962 show a marked decrease in the size of crabs in Alitak Bay. Catch statistics show the same trend. While this decline in weight and size is not unusual in heavily exploited fisheries, its effect will not be felt for 7 years (time it takes for larva to become legal crab) if reproductive success is effected.

In conclusion, a 7 inch size limit is definitely justified economically and will serve a biological safeguard until more concrete data on king crab reproductive potential can be obtained.

cc: Howard D. Tait  
Bob Simons

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Appendix B.1.—Justification for red king crab 5.75-in size limit as presented in a report of unknown origin that was archived by Donaldson (1992).

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While females molt every year after they have attained maturity, males go through the process less frequently after attaining adulthood in about their fifth year. There is evidence that they molt every other year for awhile and then every third year - if some fisherman hasn't succeeded in catching them in the meantime.

Alaska conservation regulations restrict the taking of King Crab to males with at least a seven-inch carapace and all females must be restored to the sea unharmed. A seven-inch male crab is in its seventh or eighth year, depending on what sub-specie it's from and the area it is in. Such a male has been a breeder for two or three seasons and biologists hope that a stable stock of king crab can be sustained at a maximum level by the seven-inch restriction on males, plus the prohibition of all fishing during the breeding season and a reasonable time before and after it when propagation migrations are in progress.

During 1968 the Alaska Department of Fish and Game imposed emergency restrictions on king crabbing because of serious reductions in the available stocks. They effected the largest producing areas in the state, from Kodiak Island westward into the Aleutian Islands and the Bering Sea.

Subsequently these emergency restrictions were formally made permanent, effective for 1969, by the Alaska State Board of Fish and Game.

The only exception permitted for the taking of king crab under seven inches was in the Bering Sea and that was limited to the approximate times that foreign fishing fleets (Japanese and Russian) are in the same area and are permitted (by international agreements) to take smaller crab. During such times the Alaskan fishermen may keep crab as small as 5 3/4-inches across their back shells.

Fishing for king crab has no time limits in the Bering Sea although the authority to declare emergency closures there when foreign fleets are not fishing, rests with the state fish and game biologists. In the Aleutian Islands and all coastal waters to and including the Kodiak region, fishing has been restricted to a five-month season - from August 15th to January 15th. Eastward of Kodiak fishing time is more liberal but these areas are not heavy producers. In Cook Inlet and on Prince William Sound fishing is allowed for a seven-month season - from August through February - and in Southeastern Alaska it is allowed from August 1st to mid-March.

A quota basis regulation is also being tried in the Cook Inlet region to provide state scientists with experience in this type of restricting so that they can use it elsewhere later on if it proves feasible. This type of restriction allows a limited amount of crab to be harvested - 4 1/2 million pounds a year in the case of the Cook Inlet trial - during the prescribed season.

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Appendix B.2.—Alaska Department of Fish and Game staff proposal to the Alaska Board of Fisheries, 1976, regarding red king crab size limits for the Bering Sea.

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5 AAC 34.920. SIZE LIMITS. (a)(b)(c)(Regulation page 55)(New subsection). Increase the minimum legal size for king crab in the Bering Sea during March through October.

The proposed regulation reads as follows:

5 AAC 34.920. SIZE LIMITS. (a) King crab 6-1/2 inches or greater in width of shell may be taken or possessed [DURING THE OPEN SEASON BETWEEN NOVEMBER 1 AND THE LAST DAY OF FEBRUARY].

(b) Repealed effective, 1976. [KING CRAB 6-1/4 INCHES OR LARGER IN WIDTH OF SHELL MAY BE TAKEN OR POSSESSED DURING THE OPEN SEASON BETWEEN MARCH 1 AND OCTOBER 31].

Justification: The 6-1/4 inch minimum legal size was originally adopted to coincide with the size limit effective for foreign fishermen in the Bering Sea. With the elimination of foreign effort the size limit should be at optimum size of 6-1/2 inches throughout the season.

Proposed by: Staff

Favor:

Opposed:

Action Taken:

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Appendix B.3.—Industry proposal to the Alaska Board of Fisheries, 1983, regarding Bering Sea golden king crab size limits for the Bering Sea.

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5 AAC 34.910(f) and 920(c). FISHING SEASONS and SIZE LIMITS. (New Subsections). (Regulation pages 70 and 71). Set a season and size limit for brown [now golden] king crab for the Northern district.

The proposed regulation reads as follows:

5 AAC 34.910. FISHING SEASONS.

(f) in the Northern district, male brown king crab 5-1/2 inches (140 mm) or greater carapace in width of shell may be taken or possessed from 12:00 noon May 1 through 12:00 noon September 30.

5 AAC 34.920. SIZE LIMIT.

(c) male brown king crab 5-1/2 inches (140 mm) or greater in width of shell may be taken or possessed in the Northern district.

Justification: The regulation would establish a fishing season to utilize brown [now golden] king crab in an area where no commercial fishery has existed. The Northern district red and blue king crab size limit is lower than the size limit in the Pribilofs because of slower growth. The Northern district was fished for brown crab in 1982, and we only averaged two legal 6-1/2 inch crabs per pot. If the size limit would have been 5-1/2 inches, we could have caught 20 to 30 per pot. I believe the growth is slower on brown king crab, therefore, the size limited is biologically justified.

Proposed By: Trans-Pacific International Industries (135, 136)

Favor: Unalaska/Dutch Harbor AC (64 Size limits-North Pacific Fishing Vessel Owner's Assn. (75)

Oppose: Fishing seasons-North Pacific Fishing Vessel Owner's Assn. (75) Norton Sound AC (85)

Action Taken:

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Appendix C.—Alaska Department of Fish and Game staff proposal to the Alaska Board of Fisheries, 1982, regarding snow crab size limits for the Bering Sea.

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5 AAC 34.520. SIZE LIMIT FOR TANNER CRAB. (New section). Establishes a size limit for *C. opilio*.

The proposed regulation reads as follows:

5 AAC 35.520. SIZE LIMIT. (a) *Male tanner [now snow] crab of the species Chionocetes opilio 3.1 inches (78 mm) or greater in width of shell may be taken or possessed.*

Justification: Crab stocks in the Westward Region have generally declined in recent years, thereby increasing harvesting pressure on newly developed fisheries such as the fishery for *opilio* Tanner crab [now snow crab]. It is, therefore, necessary to establish a minimum biological size limit to protect these stocks from possible overharvest. Such a size limit was established in 1976 for *bairdi* Tanner crab. The rationale for the *bairdi* size limit is that size at which 50% of the male crab population is sexually mature plus one year's growth. The *bairdi* size limit has proven successful in protecting the reproductive character of the stocks. Extending the same rationale to the *opilio* fishery results in a minimum size limit of 78 mm or 3.1 inches.

Proposed By: Staff (IV)

Favor:

Opposed:

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